

CHAPTER 59: Shaping the World—the White Technological Revolution

The world today is dominated by technology as never before. The innovations created as a result of the Industrial Revolution, in particular, dominate the entire planet and can be found across the four corners of the globe.

While this is commonly known, and countless books and works have been written on the subject, all have ignored one crucial feature of this astonishing technological revolution. These innovations, which have set the pace for the entire world, are exclusively the product of a tiny minority of whites. This fact, like so many other unpalatable truths in history, is ignored because of its political implications.

MAN OF THE MILLENNIUM—JOHANNES GUTENBERG



Johannes Gutenberg (1400–1468) revolutionized civilization with his invention of the printing press in 1436. His device, based on the concept of a wine press, was the first form of printing to use molding and casting of movable metal type. No other invention did more to spread learning and knowledge than Gutenberg's, and to this German must go the credit for being one of the most significant inventors of all time. In the year 2000, he was chosen by an international panel as the Man of the Millennium for his earth-changing invention.

Ancient Origins of Technology

While it is often claimed that the modern technological age began with the Industrial

Revolution, the reality is that many of the technologies which have shaped the modern world predate that time by a great many years. This is not to downplay the importance of the Industrial Revolution, which, in a period of perhaps two hundred years, saw science and technology leapfrog in terms of development.

Ancient Inventors

- Archimedes (287–212 BC) was a classical Greek inventor who defined the principle of the lever, and is credited with inventing the compound pulley. During his stay in Egypt, he invented the hydraulic screw for raising water from a lower to a higher level.

He is best known for discovering the law of hydrostatics, often called Archimedes' Principle, which states that a body immersed in water is buoyed up by a force equal to the weight of the fluid displaced by the object.

He also invented the catapult and the first “laser beam”—a system of mirrors he developed for the kingdom of Syracuse which focused the sun's rays on invaders' boats and set them on fire—the basic principle behind a magnifying glass.

- Ctesibius (third century BC) was a classical Greek inventor who won fame for his invention of a number of devices which used the pressure created by air and water. He also constructed an air-powered catapult using water weights (containers made heavy by being filled with water) and compressed air.

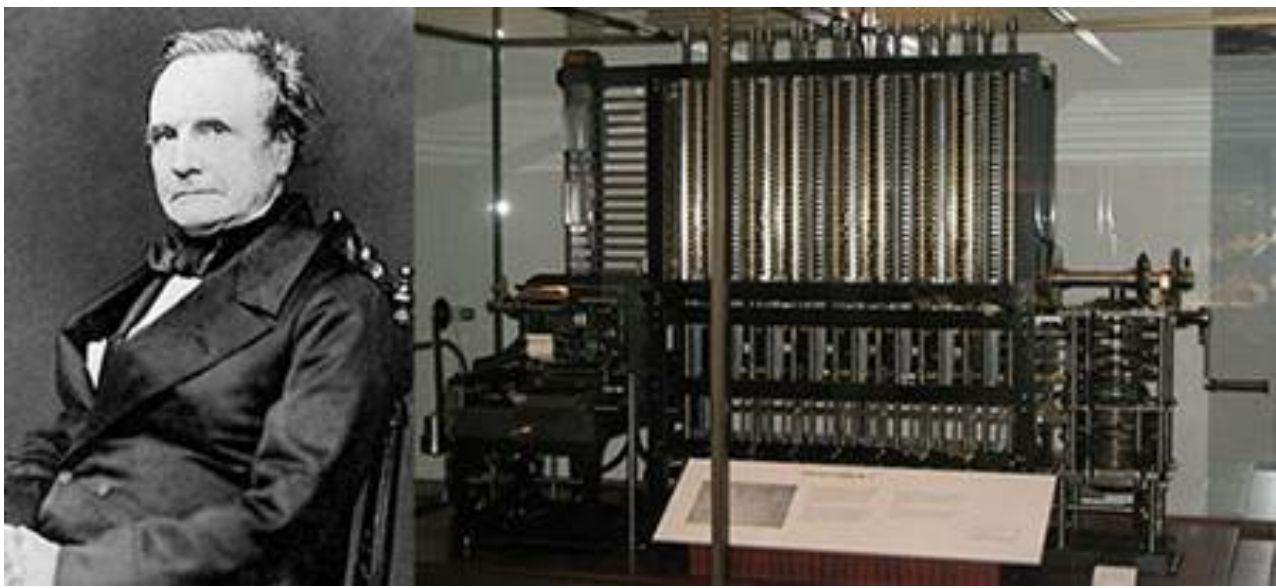
His most famous invention was the great improvement he made to the ancient Egyptian clepsydra, or water clock, in which water dripping into a container at a steady rate raised a float that carried a pointer to mark the hours. He equipped the float with a rack that turned a toothed wheel and made the clock work a number of adornments: whistling birds, moving puppets, ringing bells, and other gadgets.

The accuracy of Ctesibius's water clock was only eventually surpassed in 1657 by the pendulum clock of Dutch inventor Christiaan Huygens, but the spirit of Ctesibius's clock still survives in the cuckoo clock.

- Leonardo da Vinci (1452–1519) was not only a great artist, but also an inventor, whose surviving documents and manuscripts are filled with designs for many of the machines regarded as nineteenth or twentieth century inventions, but which were in fact modeled in his sixteenth century plans.

These designs included: portable bridges, cannons, armored vehicles, a submarine, an underwater diving suit, and models for aircraft.

CHARLES BABBAGE AND MECHANICAL COMPUTERS



Charles Babbage and a working model of his mechanical computer, the Difference Engine.

Computers

The history of the computer serves as another excellent example of how some modern technology has its origins in the era which predates the Industrial Revolution.

- The first computer—a machine which could do mathematical equations—was built as early as 1623 by the German scientist Wilhelm Schikard. He built a machine that used eleven complete and six incomplete sprocketed wheels that could add and, with the aid of logarithm tables, multiply and divide.

- In 1642, the Frenchman Blaise Pascal invented a machine that could add and subtract, all the while using a system which automatically carried and borrowed digits from column to column. The seventeenth century German mathematician, Gottfried Leibniz, designed a special gearing system to enable Pascal's machine to do multiplication as well.

- The first programmable computer was developed in 1804 when the Frenchman, Joseph-Marie Jacquard, invented a spinning loom which used punched cards to program preselected patterns. Jacquard was rewarded by Napoleon Bonaparte for his work, but was forced to flee Lyon when he was attacked by weavers who saw their livelihoods endangered by his invention. His looms are still used today, especially in the manufacture of fine furniture fabrics.

- The British mathematician and inventor, Charles Babbage, started building, but never completed, two astonishing computers called the Difference Engine and the Analytical Engine. The latter machine laid the foundational concepts upon which all modern computers were developed. Although he completed all the plans, Babbage never managed to finish building his machines due to financial constraints.

Many of the ideas surrounding Babbage's computers were recorded by his friend, Augusta Ada Byron, the daughter of the famous poet Lord Byron. Ada's conceptual programs for the engines led to the naming of a programming language (Ada) in her honor.

Although the Analytical Engine was never built, its key concepts, such as the capacity to store instructions, the use of punched cards as a primitive memory, and the ability to print, were taken by others and can be found in many modern computers.

- The German American, Herman Hollerith, developed a device which could electronically create and read the punched cards developed by Jacquard. Hollerith's tabulator was used for the 1890 US census and cut the counting time by three quarters. The company he started, known as the Tabulating Machine Company, later merged with a number of other enterprises, and by 1924 became the world-famous International Business Machines Corporation, or IBM.

- The precursor to the modern digital computer came in 1936, when the British mathematician Alan Turing developed the Turing Machine—a device that looked like a typewriter and which could process equations without human direction. Computer keyboards were developed from this machine's buttons and key layout.

- In the 1930s, the American mathematician, Howard Aiken, developed the Mark I calculating machine, which was built by Hollerith's IBM. This electronic calculating machine used relays and electromagnetic components to replace mechanical devices. Aiken also introduced computers to universities by establishing the first computer science program at Harvard University.

- During the Second World War, computer technology leapfrogged. The British developed a massive analogue computer which was able to read encrypted German field signals sent by the famous "Enigma" device. These transmissions were considered unbreakable due to the large number of possible combinations involved, but the supercomputers at Bletchley Park, in Buckinghamshire, proved to be the undoing of the German codes.

- The first successful digital computer, the Electronic Numerical Integrator and Computer (ENIAC), was invented by the American, John Mauchly, at the University of Pennsylvania in 1945. Many of ENIAC's first tasks were for military purposes, such as calculating ballistic firing tables and designing atomic weapons. Mauchly and a partner formed their own company, and produced the Universal Automatic Computer (UNIVAC), which was used for a broader variety of commercial applications.

- In 1948, at Bell Telephone Laboratories, American physicists Walter Houser Brattain, John Bardeen, and William Bradford Shockley developed the transistor, a device that could act as an electric switch.

The transistor had a tremendous impact on computer design, replacing costly, energy-inefficient, and unreliable vacuum tubes.

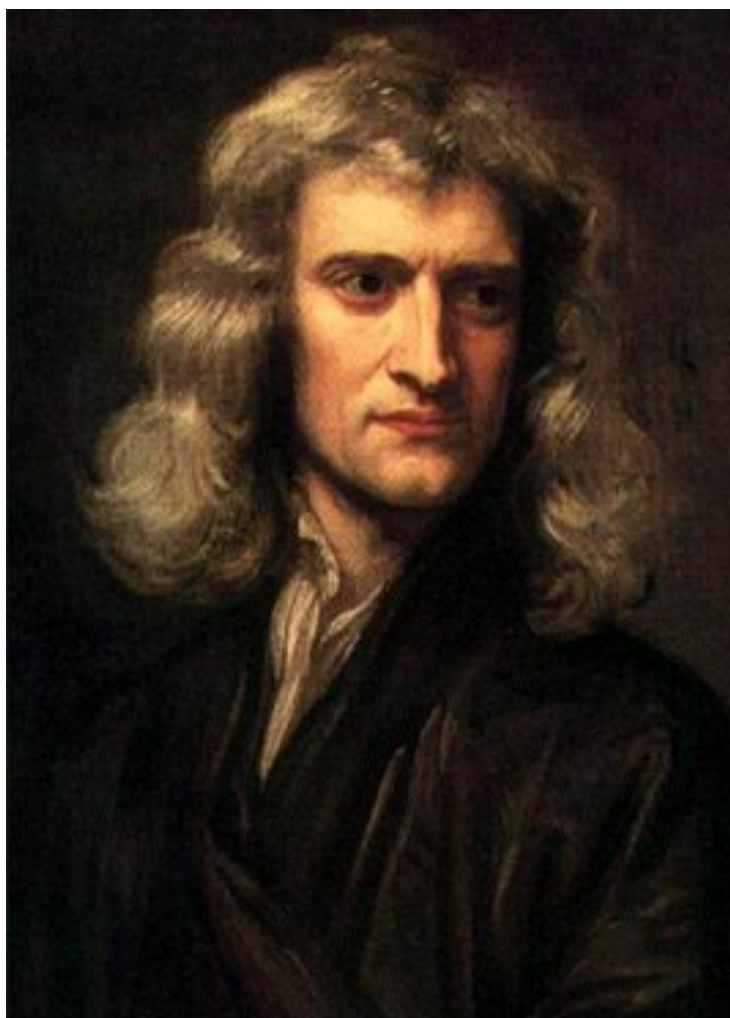
- Integrated circuits, pioneered in America in the late 1960s, enabled internal computer circuitry to be miniaturized. This breakthrough led directly to the present-day personal computer.

European Inventors and Their Inventions

- John Napier (1550–1617) was a Scottish mathematician who invented the first system of logarithms, described in his book *Canonis Descriptio* (1614). He also invented mechanical systems for performing arithmetical computations, described in his book *Rabdologia* (1617).

- Sir Christopher Wren (1632–1723) was an English architect, scientist, and mathematician who designed many great buildings, invented a weather clock which was the forerunner of the barometer, and undertook pioneering work in the development of blood transfusion.

ISAAC NEWTON



Isaac Newton (1642–1727) was a great organizer of classical physics and made many new discoveries in mechanics and astronomy. His ideas were so complete and far-reaching that nearly four hundred years after he lived, the laws which he laid down are still used in scientific calculations.

- Sir Isaac Newton (1642–1726) was an English scientist who worked out an all-encompassing mechanical explanation of the universe resting upon the law of universal gravitation. His work was so far reaching that it was still used in the twentieth century when space exploration was planned.

- Samuel Crompton (1753–1827) was an Englishman who invented the spinning mule, a machine that was able to spin cotton into thread finer and faster than was possible with hand spinning. Foolishly, he sold the design for the machine for a mere sixty pounds. While it became the most important machine in the British textile industry, Crompton lived in dreadful poverty until the British Parliament voted to give him £5,000 in 1812, in recognition of his innovation.

- John Kay (1704–1764) was an Englishman who invented the Flying Shuttle in 1733 which increased weaving speed. He was attacked by weavers who saw his invention as a threat to their livelihoods and Kay fled to France, where he died in poverty.

- Sir Richard Arkwright (1732–1792) was a British inventor, who, in 1769, designed a spinning frame in which cotton fiber was spun into thread.

- Edmund Cartwright (1743–1823) was an Englishman who invented the power loom in 1785. Cartwright also invented a wool-combing machine (1789) and a steam engine fueled by alcohol (1797). He was awarded £10,000 by the British Parliament in recognition of his innovations, as the power loom laid the basis for the Industrial Revolution.

- James Hargreaves (1720–1778) was an Englishman who, in 1764, invented the Spinning Jenny (named after his daughter) which made possible the automatic production of cotton thread.

- James Watt (1736–1819) was a Scottish inventor who won fame for his development of the first viable steam engine, a device which had originally been invented by the English engineers Thomas Savery and Thomas Newcomen. The first steam engines were thundering devices which were used to pump water from mines. Watt's first patent, in 1769, fixed many of their mechanical flaws and provided for a host of innovations such as steamjacketing, oil lubrication, and the insulation of the steam generating cylinder. Watt also invented the rotary engine which drove various devices including the double-action engine (in which steam was admitted alternately into both ends of the cylinder), the steam indicator (which recorded the steam pressure in the engine), the centrifugal or flyball governor (which automatically regulated the speed of an engine), and an attachment that adapted telescopes for use as land surveying equipment. The latter device is still in use today. In honor of his achievements, the electrical unit, the "watt," was named after this prolific inventor.

- Edward Jenner (1749–1823) was an English physicist who pioneered the use of vaccines, most notably against smallpox.

- Louis Jacques M. J. M. Daguerre (1789–1851) was a Frenchman who invented the daguerreotype method of photography which used metal plates, which was, until the development of roll film, the most common form of photography.

- Joseph Nicéphore Niépce (1765–1833) was a Frenchman who invented the first process for capturing permanent photographic images. In 1826, he successfully made the first surviving permanent photograph, of the courtyard of his house, using a bitumen-coated pewter plate.

- Robert Wilhelm Bunsen (1811–1899) was a German chemist who invented the spectroscope and discovered spectrum analysis which led to the discovery of the elements cesium and rubidium. Bunsen also discovered that iron oxide hydrate could be used as an antidote for arsenic poisoning. Although his name was given to the Bunsen burner, he did not develop that device. He did, however, invent a number of other instruments, including the ice calorimeter, the filter pump, and the zinc-carbon electric cell.

- Ernst Werner von Siemens (1816–92) was one of a family of German engineers who founded the firm bearing his name. He invented the electric dynamo and pioneered the use of gutta-percha, the rubberlike substance which insulates electric cables. He also built the first electric streetcar (cable car), which made its debut in Berlin in 1879, and the world's first electric train.

- Michael Faraday (1791–1867) was a British physicist who invented the gas burner (later known as the Bunsen burner), still used today in scientific laboratories. His other great innovations included the development of benzene and electromagnetic induction. He also formulated the laws of electrolysis which bear his name.

HENRY BESSEMER—MODERN STEEL WIZARD



Sir Henry Bessemer (1813–1898) was a British industrialist and metallurgist who, in 1856, developed a technique for the production of strengthened quality steel, called the Bessemer process. The Bessemer method spread rapidly all over the world, and Bessemer was awarded many foreign honors for his breakthrough, including the Order of Franz Josef of Austria and a medal from Napoleon III of France. He was also knighted in Britain.

- Sir Henry Bessemer (1813–1898) was the British inventor of a revolutionary process for the manufacture of steel, patented in 1856.

- Richard Trevithick (1771–1833), the father of railway travel, was a British mechanical engineer and inventor who developed the first mobile steam engines. He improved James Watt's steam engine design and, by 1801, had developed the first passenger-transporting trains. Three years later, the first railway tracks were laid and the age of train travel started.

- George Stephenson (1781–1848) was a British engineer who designed a new locomotive which could carry passengers and cargo. This engine, known as the *Rocket*, was unveiled in 1829 and stimulated the railway building industry even more than Trevithick's work.

The first locomotive engine was sent to North America from England the same year that the *Rocket* was unveiled.

- Alfred Nobel (1833–1896) was a Swedish inventor who devised military weapons such as mines, torpedoes, and dynamite.

- Guglielmo Marchese Marconi (1874–1937) was an Italian electrical engineer who won fame with the first practical radio-signaling system. In 1897, he formed Marconi's Wireless Telegraph Company, Ltd., in London and, in 1899, established radio communication across the

English Channel between England and France. In 1901, he was the first to send radio signals across the Atlantic Ocean between England and North America. During World War I, he was in charge of the Italian wireless service and developed shortwave transmission as a means of secret communication. The American-based Nikola Tesla developed a similar system before Marconi filed his patents, and a longstanding dispute between the two erupted over who had invented the radio. Marconi, however, remains the most popularly credited inventor, and he certainly made the device commercially successful.

- Vlademar Poulsen (1869–1942) was a Danish inventor who developed the first tape recorder in 1898, using a magnetized steel tape in what he called the telegraphone. The magnetic tape common today in tape recorders was developed in Germany during the Second World War.

- Louis Pasteur (1822–1895) was a French scientist who is best remembered for developing the process of pasteurization, which is the sterilization of milk and other substances. He also founded the science of microbiology and developed vaccines for a wide range of diseases including anthrax and rabies.

- Gregor Mendel (1822–1884) was a German monk who discovered the laws of genetics through research with garden peas. Mendel described the patterns of inheritance in terms of seven pairs of contrasting traits that appeared in different pea plant varieties. He observed that the traits were inherited as separate units, each of which was inherited independently of the others. He found that each parent has pairs of units but contributes only one unit from each pair to its offspring. The units that Mendel described were later given the name genes.

He published his findings in 1866, and they became known as Mendel's Laws of Inheritance.

- Louis Lumiere (1864–1948) was a French pioneer of motion photography who, with his brother Auguste, invented an early motion picture system and made the first proper film in 1895, showing it to the public in that same year: the first cinema show in the world.

North American Inventors and Their Inventions

- Benjamin Franklin (1706–1790) won fame for writing much of the American Constitution, but was an inventor in his own right. Franklin devised devices to control smoking chimneys (which were the first anti-pollution measures) and, in 1744, invented the Franklin Stove, which furnished greater heat with a reduced consumption of fuel.

His most famous discovery came in 1747, when he proved that lightning was an electrical phenomenon. He also invented the lightning rod.

- John Fitch (1743–1798) developed the first American steamboat in 1787. Fitch's craft, which he patented in America and France in 1791, made up the first regularly scheduled steamboat line.

- Eli Whitney (1765–1825) is best known for his 1793 invention of the cotton gin, a machine that would separate the seeds from the fibers of the short-staple cotton plant, work previously done laboriously by hand.

- David Bushnell (1742–1824) built the first submarine in 1775. Called the *Turtle*, the one-passenger craft was a tarred, oaken sphere banded with iron and powered by hand-operated propellers and pumps. Designed for military use, its armament was an outside gunpowder bomb with a time fuse.

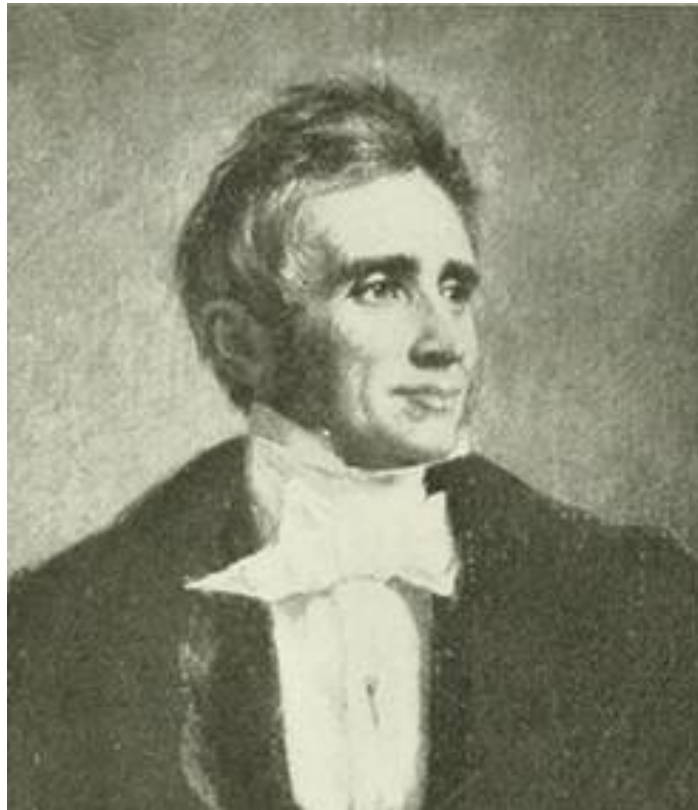
- George Henry Corliss (1817–1888) invented the Corliss valve in 1849, which regulates the flow of steam into an engine cylinder. The concept was then used in all valve-operated engine systems.

- Gail Borden (1801–1874) invented the process for condensing milk and conserving foods.

- John Ericsson (1803–1889) was the Swedish-born co-designer of the steam locomotive, the *Novelty*, which was the main competition to George Stephenson's *Rocket*. Although Ericsson's design failed mechanically during a race between the *Rocket* and the *Novelty*, it was the first locomotive to travel a mile in under a minute.

Ericsson also invented the screw propeller for ships (until then all ships had used oars or paddlewheels), with the first screw driven ship, the *Francis B. Ogden*, launched in 1837. In 1870 Ericsson patented the first solar-powered engine which used sunlight to boil water. The steam which it created was then used to drive machinery.

CHARLES GOODYEAR



The American inventor Charles Goodyear (1800–1860) who invented vulcanized rubber.

- Charles Goodyear (1800–1860) was a chemist who invented vulcanized rubber by mixing rubber and sulphur at high temperatures. This 1839 invention is still the basis of the rubber-manufacturing industry.

- Elisha Gray (1835–1901) became one of the more tragic inventors in American history when he handed in his patent for the telephone a few hours after Alexander Graham Bell handed in his. The credit for the telephone went to Bell, although Gray's device had been developed simultaneously. In 1888, Gray patented a facsimile telegraph system, and he founded the Western Electric Company.

- John Moses Browning (1855–1926) invented some of the most widely used weapons in the history of firearms. He developed several major innovations in gun technology, including breech- and automatic-loading systems, and repeating rifles and shotguns.

- Edwin Howard Armstrong (1890–1954) developed several electronic circuits and systems that were crucial to the development of radio, including the regenerative circuit (1912) and the frequency modulation (FM) radio broadcasting system.

The regenerative circuit amplified weak radio signals and revolutionized the range of radio broadcasting. The FM broadcasting system is in common use today.

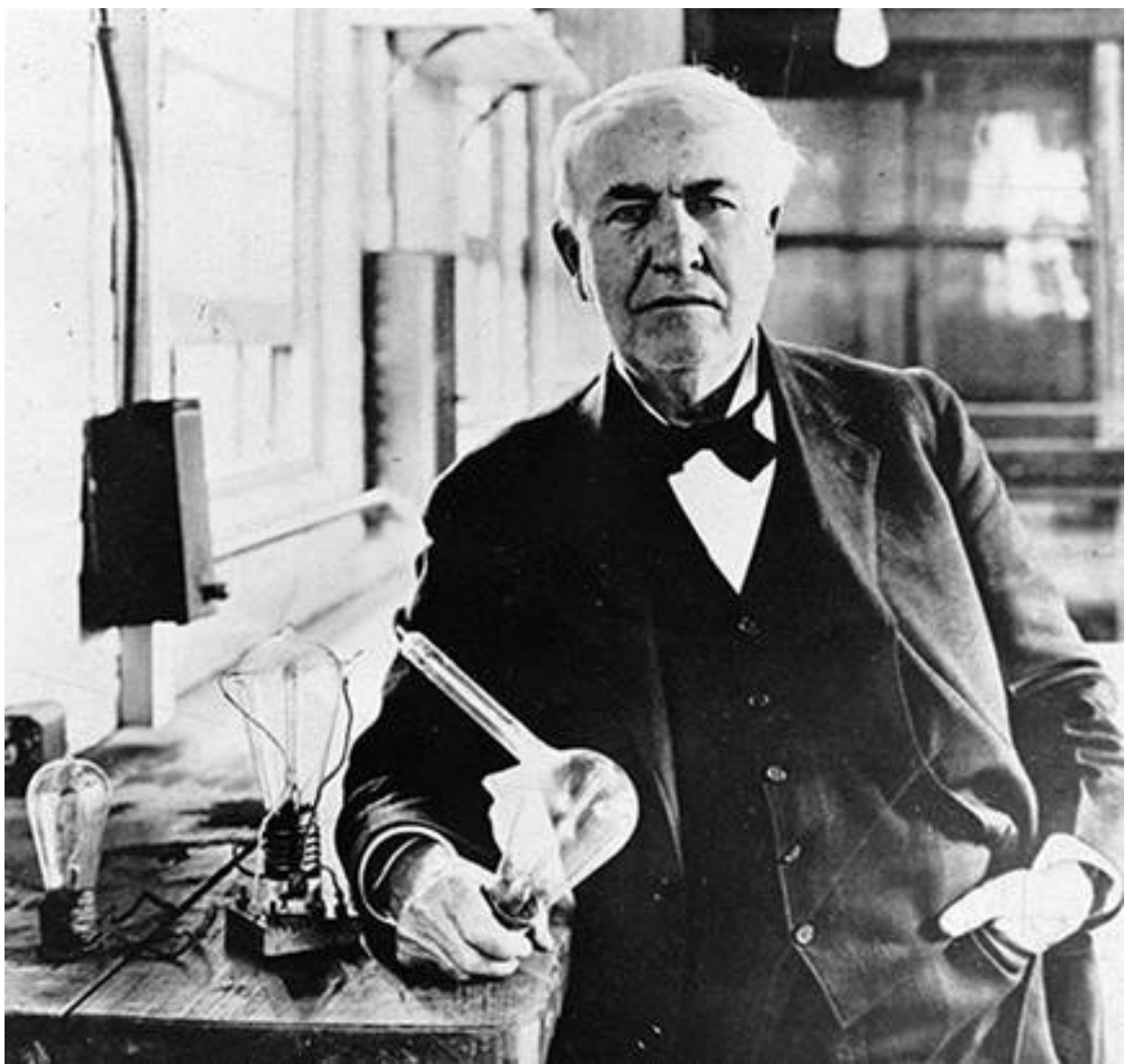
- Lee De Forest (1873–1961) designed a number of the earliest wireless radio and telegraph transmitters. His most important invention, however, was a type of vacuum tube that De Forest called the audion, and which today is known as the triode. The triode was the key component of all radio, radar, television, and computer systems until its replacement by the transistor in the early 1950s.

- John Deere (1804–1886) designed the steel ploughshare in the 1830s, replacing the cast iron version. The company he formed in Illinois became famous for the manufacture of all farming implements.

- Charles Edgar Duryea (1861–1938), with his brother, James Frank Duryea, built the first successful gasoline-powered automobile in America in 1894.

- George Eastman (1854–1932) patented the first practicable roll film in 1884. Prior to this, photography was limited to a tiny few, but Eastman's development placed photography within the reach of the large mass of consumers. In 1888, he perfected the Kodak camera and in 1889 invented flexible transparent film, which allowed the development of the motion picture industry.

THOMAS EDISON—LIGHTING THE WORLD



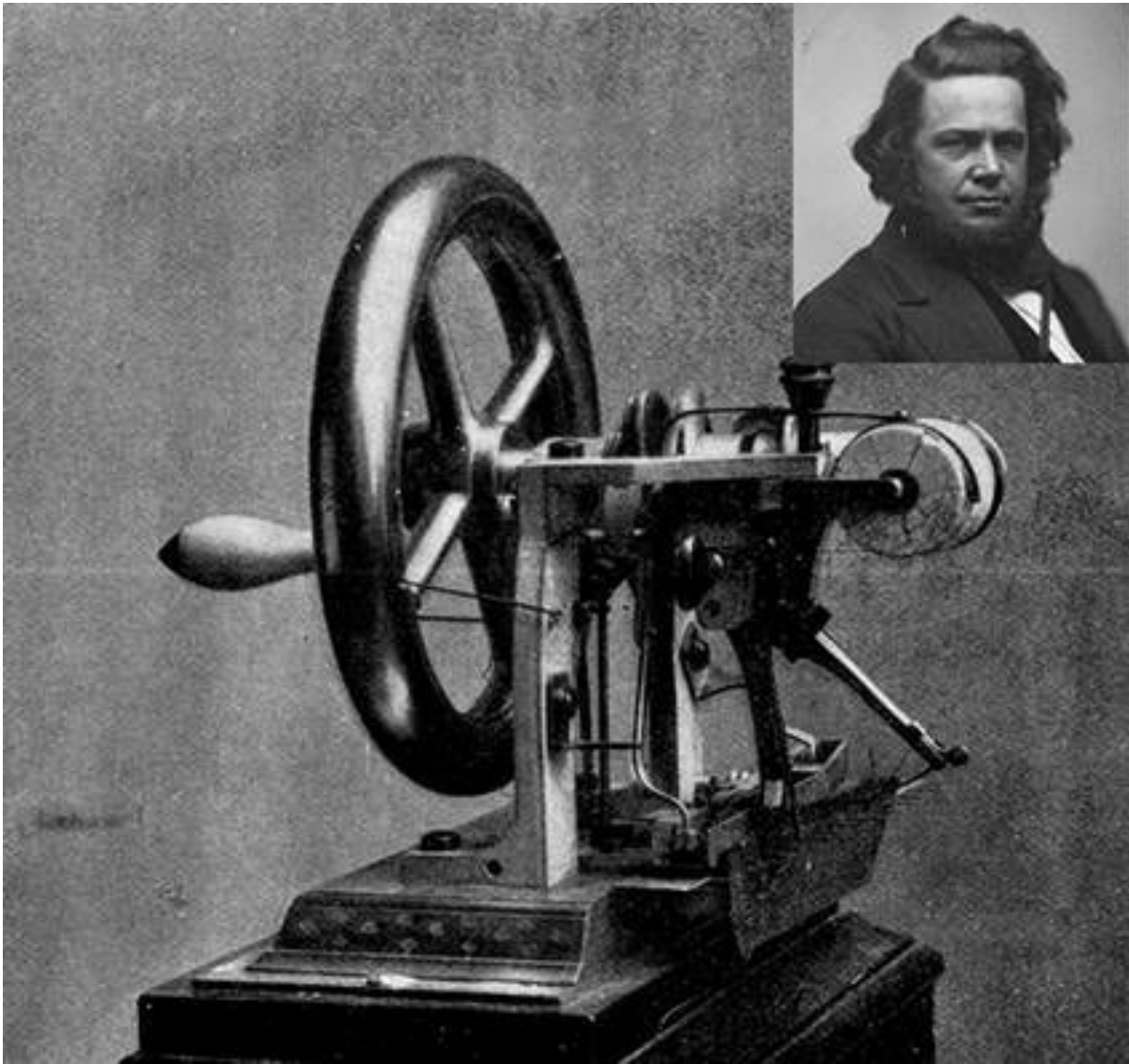
Thomas Alva Edison (1847–1931) was the inventor of the first practical incandescent lamp. This invention literally changed the physical appearance of the world, as electric lights can even be seen from space. This 1879 invention was one of Edison’s many works of genius which totaled over one thousand innovations and included the phonograph and a practical motion picture camera.

- Thomas Alva Edison (1847–1931) was a prolific inventor who developed the electric light bulb, an electric generating system, the phonograph, a sound recording device using a round cylinder (he would later adapt it to record on a flat disc, which became the “record player”), and the motion picture projector, or Kinetoscope. By synchronizing his phonograph and Kinetoscope, he produced, in 1913, the first talking moving pictures. In 1882, he developed and installed the world’s first large central electric power station, located in New York City. He also developed a commercial version of the battery, the mimeograph, the microtasmeter (used for the detection of minute changes in temperature), and a wireless telegraphic method for communicating with moving trains. Altogether, Edison patented more than one thousand inventions.

- Sherman Mills Fairchild (1896–1971) invented several cameras and designed the first enclosed cockpits on aircraft. He also invented the radio compass and hydraulic brakes and landing gears for aircraft. He founded the company, Fairchild Industries, in New York.

- Richard Jordan Gatling (1818–1903) won renown as the inventor of the Gatling Gun, the world’s first repeat firing machine gun.

ELIAS HOWE—SEWING MACHINE INVENTOR



Elias Howe, the American born inventor who developed the sewing machine, only to have his copyright infringed by Isaac Singer who mass-produced Howe's machine while he was in Europe. Upon his return, Howe sued Singer, won, and was awarded significant damages. Above: The Elias Howe machine, September 10, 1846. Earliest model filed in Patent Office.

- Elias Howe (1819–1867) won fame when, in 1837, he designed, and, over the next nine years, built the sewing machine, for which he took out a patent in 1846. He then went to England, returning a few years later to find that Isaac Singer had stolen his patent and had started mass manufacture of the sewing machine under the Singer trade name. Howe pursued Singer in court, during the course of which unfounded charges of anti-Semitism were made against Howe by Singer, who was Jewish. After several years, Howe won the legal tussle. Singer was ordered to pay the inventor royalties on all Singer sewing machines ever produced, and Howe retired a wealthy man.

- Charles Franklin Kettering (1876–1958) invented some of the most recognizable items of modern life. They include: the electric automatic starter which he built specifically for automobiles, but later used for many other applications; the first electronic cash register, developed while he was working for the National Cash Register (NCR) company; the first engine-powered electricity generator; quick drying automobile paint; high octane and leaded gasoline; a nonpoisonous coolant for refrigerators, and the first practical engine for diesel locomotives.

• Herbert Edwin Land (1909–1991) won fame through his work in polarized light: he developed a new kind of polarizer, which he called Polaroid, by aligning and embedding crystals in a plastic sheet. Starting his own laboratory at the age of nineteen, he started the Polaroid Corporation in 1937, which developed infrared filters, dark adaptation goggles, and target finders. In the late 1940s, the corporation produced the first self-developing Polaroid Land camera.

• Hiram Percy Maxim (1869–1936) was one of a family of inventors. His father invented the Maxim machine gun and cordite. Other Maxim inventions included an electric automobile in 1897 and silencer devices for rifles and air compressors.

• Cyrus Hall McCormick (1809–1884) invented the first successful reaping machine in 1831. The technical innovations in this machine contributed greatly to the development of modern agriculture and have been included in every successful reaper manufactured since. The garden lawnmower is based on his original invention.

• Samuel Morse (1791–1872) won fame for his inventions of the electric telegraph and the Morse code. In 1843, the US Congress appropriated \$30,000 for Morse to construct an experimental telegraph line between Washington DC, and Baltimore, Maryland. The line was successfully installed and, on May 24, 1844, Morse sent the first telegraph message: “What hath God wrought!”

• Graves Otis (1811–1861) pioneered the construction and manufacture of steam-powered elevators. He founded the Otis Elevator Company.

• George Mortimer Pullman (1831–1897) designed the first railway sleeping coach. His factory developed into its own town, Pullman, in Illinois.

• Christopher Sholes (1819–1890) invented the first practical typewriter in 1867, perfecting a design which had first been attempted in 1714 by Henry Mill in England. The development of the machine was incredibly difficult and no less than seventy-six attempts preceded Sholes’ successful design. In 1873, Sholes signed a contract with the Remington Arms Company, a gun manufacturer, to build and market the typewriter. Sholes developed the “QWERTY” keyboard (still in use in modern English language computers) to overcome the problem of typewriter keys sticking at the point of contact with the ribbon. The keys for the letters that most often appear in combination in the English language are located far apart on the keyboard.

• Elmer Ambrose Sperry (1860–1930) patented more than four hundred inventions including the electric-arc light, electric streetcars, improvements to electric motors, the gyrocompass, the gyropilot for steering ships, the automatic gyropilot for stabilizing aircraft, and electrically sustained gyros that control submarine and aerial torpedoes.

• Nikola Tesla (1856–1943) was a Croatian-born American electrical engineer who, in 1888, designed the first practical system of generating and transmitting alternating current for electric power. In 1895, Tesla’s alternating-current motors were installed at the Niagara Falls Power Project.

• George Westinghouse (1846–1914) won fame for inventing the railway frog, a device which permits trains to cross from one track to another. In 1868, he invented the airbrake, for which he became most famous.

• Chester F. Carlson (1906–1968) invented xerography, an electronic dry-copying process for the reproduction of images or documents, now called photocopying.

• Alexander Graham Bell (1847–1922) was a Scottish-born American inventor who won

fame for inventing the telephone. He also invented the aileron, a device used in every aircraft to control the rate of lift through the air. He founded the Bell Telephone Company and his descendants founded the *National Geographic* magazine.

The Real Origin of Paper

It is often claimed that paper was invented in China or Egypt. In reality neither of these two civilizations had paper. A textile-based parchment had been invented in China, and the ancient Egyptians used bound and stamped reeds (papyrus) as parchment. The very earliest writing parchments in Europe were also made out of textiles, but there is no evidence that this development was transmitted from the East.

In Europe, scraps of textiles were pulped by hand in order to make them thin enough to be used as writing material. This process was revolutionized in 1798 by the French scientist Nicholas Louis Robert, who invented the first mechanical paper pulping machine. The raw material was, however, still crude textile. Robert's machine was improved by Henry and Sealy Fourdrinier, British stationers and brothers, who, in 1803, produced the first of the machines that bear their name.

In 1850, a German, Friedrich Gottlob Keller, devised the first method of making paper from wood pulp, and an Englishman, Hugh Burgess, improved upon this process in 1852 by mixing the wood pulp with chemicals.

In 1867, the American chemist C.B. Tilghman added sulfites during the pulping process, and finally, in 1879, C.F. Dahl, a Swede, perfected the use of wood pulp by adding yet another chemical. Modern paper is thus exclusively a European invention.

Printing

As with paper, it is often claimed that printing was invented in China. This is also untrue. The Chinese did develop a clever system of pattern stamping in which a strip of material was laid against a water based painted picture to transfer the image, but this worked only for very basic patterns and was consequently not widespread. There is also no evidence that this technique was ever exported outside of China.

In Europe, printing was developed by the German Johann Gutenberg in the city of Mainz in 1450. Gutenberg based the design of his printing machine on a wine press, and developed raised and movable type. He also pioneered the use of oil-based inks for printing. The invention of the printing press revolutionized the spread of knowledge. The first printing press was built in Venice in 1469, and by 1500, the city possessed 417 printers. In 1476, a printing press was built in England by William Caxton. The Spaniard Juan Pablos imported a printing press to Mexico City, Mexico, in 1539. This was the first printing press in North America. In 1628, Stephen Day set up America's first printing press at Massachusetts Bay in 1628.

Gunpowder

The first written reference to the plans to manufacture gunpowder appeared in the writings of the thirteenth century English monk Roger Bacon. This contradicts the oft-held theory that gunpowder was developed in China and exported to Europe. The Chinese did possess a flammable chemical which they used in bamboo tubes to make clay pellet firing "rockets." However, a fourteenth century German monk, Berthold Schwarz, is acknowledged as the inventor of the modern gun as he used Bacon's gunpowder to fire a projectile of substantial weight at a powerful velocity. The discovery was made by accident: Schwarz was preparing gunpowder in a closed vessel called an apothecary's mortar when the mixture ignited and blew the pestle from the mortar.

The use of “mortar” for a type of ordnance has remained ever since.

The oldest European cannon dates from 1300 and was made in Sweden, while the oldest Chinese cannon dates from 1332. European cannon are also depicted in a 1326 manuscript on war by Walter de Millimete of England. Gunpowder factories had been established in England and Germany in 1334 and 1340 respectively. “Gunnis cum telar” (“guns with handles”) became widespread in Europe in the 1350s, a development which marked the emergence of the personal firearm.

The Automobile

The first self-propelled vehicle was a three-wheeled steam-powered engine developed in 1769 by the French army officer Captain Nicolas Joseph Cugnot. He was the first inventor to successfully design a device which converted the motion of a steam piston into rotary motion by means of a ratchet arrangement. Although his design failed in practice, it laid out the basic concept for all engines since.

The next steam engines were developed in England. They were adjusted to run on tracks, and from this innovation came the idea to create railway engines. Steam-driven automobiles were also developed, and although slow and cumbersome, became popular in America during the very early twentieth century. The most famous steam-driven vehicle was the Stanley Steamer, built by Americans Freelan and Francis Stanley. A Stanley Steamer established a world land speed record in 1906 of 121 miles per hour (205 kilometers per hour). The steam engine vehicle was displaced by the more powerful internal combustion engine.

Internal Combustion Engines

In 1859, Jean Joseph Lenoir (1822–1900), a Belgian-born French inventor, produced the first one-cylinder internal combustion engine powered by kerosene, and developed it into the first internal combustion engine powered vehicle. The German engineer Nikolaus Otto (1832–1891) invented the first four-stroke internal combustion engine in 1876. This revolution paved the way for the development of the modern automobile.

The German Gottlieb Daimler (1834–1900) assisted in the development of the famous “Otto” gasoline engine but won fame for his 1887 “Daimler engine,” a high-speed internal-combustion engine that was the critical breakthrough step in the development of a viable automobile. Daimler and another German inventor, Wilhelm Maybach, mounted a gasoline powered engine onto a bicycle and created the first motorcycle in 1885. They followed this innovation in 1887 with their first car, which pioneered the use of a steering lever and a four-speed gearbox. Yet another German engineer, Karl Benz, produced his first gasoline car in 1886. In 1926, Daimler, Maybach, and Benz joined together to form the Mercedes Benz brand name of automobile manufacturers.

In 1897, the German engineer Rudolf Diesel (1858–1913) designed and invented the engine which is now named after him. His design maximized energy use by injecting fuel at the end of a piston’s compression cycle (as opposed to the start, as is the case with conventional gasoline engines), which is then ignited by the high temperature resulting from the compression.

Modern tarred roads were the result of the work of two British engineers, Thomas Telford and John Loudon McAdam. Telford designed the system of raising the foundation of the road in the center to act as a drain for water: eventually this became the norm for all roads everywhere.

It is often claimed that Adolf Hitler and the National Socialist government in Germany invented the autobahn (the highway or freeway), but this development predated Hitler’s rise to

power.

The first proper automobile highway, the autostrada, was built between Milan and the northern Italian lakes in 1922. Hitler's government, however, was the first to build large numbers of autobahns which linked all the major cities across Germany, and it was this concept which was copied all over the world.

Oil Wells

The first commercial exploitation of natural oil, known originally as "rock oil," occurred in 1852 when the Canadian-German physician and geologist Abraham Gessner obtained a patent for producing kerosene from crude oil.

The first proper oil wells were dug in Germany in 1857, but the first successful oil well dig was carried out in 1859 by Edwin Drake at Oil Creek, Pennsylvania, in the United States. Drake's success marked the beginning of the rapid growth of the modern petroleum industry. George Kettering was the first scientist to distill high octane fuel from crude oil.

Electricity

- The English scientist, William Gilbert, coined the word "electricity" in 1600 when he used the Greek word for "amber" to describe the phenomenon in a book.

- In 1672, the German scientist Otto von Guericke invented the first machine to produce an electric charge.

- In 1773, the French scientist Charles Du Fay discovered the existence of two types of electricity and named them "vitreous" and "resinous" (later known as positive and negative charge respectively).

- The British scientist Joseph Priestly proved in 1766 that the force between electric charges varies inversely with the square of the distance between the charges.

- The Italian physicist Alessandro Volta developed the precursor to the modern electrical battery in 1800. The unit of electricity, the volt, was named after him in honor of his discovery.

- In 1819, the Danish scientist Hans Christian Oersted discovered that a magnetic field exists around an electric current flow.

- In 1831, the British scientist Michael Faraday proved that a current flowing in a coil of wire can electromagnetically induce a current in a nearby coil.

- In 1840, the British scientist James Prescott Joule and the German scientist Hermann von Helmholtz demonstrated that electric circuits obey the law of the conservation of energy and that electricity is a form of energy. The unit of energy, the Joule, is named after the Englishman.

- The British inventor James Clerk Maxwell investigated the properties of electromagnetic waves and light and developed the theory that the two are identical.

- The Dutch physicist Hendrik Lorentz developed the electron theory in 1892, which is the basis of modern electrical theory.

- The German physicist Georg Simon Ohm used Volta's electrochemical cell and his own

equipment to determine that the current that flows through a wire is proportional to its cross-sectional area and inversely proportional to its length. This was the beginning of electrical circuit analysis and is known today as Ohm's law.

- The American scientist Robert Millikan was the first to measure the charge on an electron in 1909.

- The widespread use of electricity as a source of power is largely due to the work of such pioneering American engineers and inventors as Thomas Alva Edison and Nikola Tesla.

- The transistor was developed at Bell Telephone Laboratories by the American physicists Walter Houser Brattain, John Bardeen, and William Bradford Shockley. For this achievement, the three shared a Nobel Prize.

Television

The concept of television was pioneered by the Scotsman, James Clerk Maxwell, who in 1873, predicted the existence of the electromagnetic waves that would enable pictures and sound to be sent by air instead of along wire as was then currently the case.

- In 1873, the English scientist, Willoughby Smith, and his assistant, Joseph May, discovered photoconductivity after observing that the electrical conductivity of the element selenium changes when light falls on it. This characteristic was used in the vidicon television camera tube.

- Photoemission, the effect that certain substances emit electrons when exposed to light, was discovered in 1888, by the German physicist, Wilhelm Hallwachs. This effect was applied to the image orthicon television camera tube.

- In 1906, the American Lee De Forest patented the triode vacuum tube. By 1920, the tube had been improved to the point where it could be used to amplify electric currents for television.

- The German engineer Paul Nipkow designed the first true television system in 1884. This consisted of a rotating punched-hole disk which scanned an image piecemeal into a camera. The scanned image was then transmitted to a receiver which used another spinning disk to reverse the procedure and reconstitute the scanned picture.

- Nipkow's mechanical scanner was used from 1923 to 1925 in experimental television systems developed in the United States by Charles F. Jenkins, and in England by the Scotsman and inventor, John Logie Baird, the latter developing the Nipkow disk system to the point where he is generally credited with the development of modern television.

- The first electronic method of scanning an image for use in conjunction with Baird's development was created by an Englishman, A.A. Campbell-Swinton, in 1908.

PHILO FARNSWORTH—FIRST PRACTICAL TV CAMERA



Philo Taylor Farnsworth (1906–1071) was an American inventor who developed the first practical television camera and receiver which provided the breakthrough from Nipkow's "Spinning Disc" system to the electronic imaging process. His first design was made when he was just 14 years old.

- The American engineer Philo Taylor Farnsworth developed the first practical television camera in 1927 (when he was just twenty-one) which converted a captured image into an electric signal. This "image dissector" was the first proper all-electronic television system.

- In 1878, the British chemist and physicist Sir William Crookes invented the Crookes tube, which was a vacuumized glass device in which high voltage transmissions were transmitted between two electrodes. The Crookes tube was used in experiments which led to the discovery of x-rays by the German physicist W. C. Roentgen in 1895 and of the electron by the British scientist J.J. Thomson in 1897.

By 1908, Campbell-Swinton and a Russian, Boris Rosing, had independently suggested that a cathode-ray tube (CRT) be used to reproduce the television picture on a phosphor-coated screen. The CRT was developed for use in television during the 1930s by the American electrical engineer, Allen B. DuMont.

- Liquid Crystal Display (LCD) technology originated in 1888 when the Austrian botanist and chemist Friedrich Reinitzer first discovered liquid crystals in cholesterol extracted from carrots. In 1962, the American Richard Williams found that running an electric current through a thin layer of liquid crystals produced striped patterns. This laid the basis for the liquid crystal display technology which became used in a vast number of electrical applications.

By 1968, American researchers George Heilmeyer, Louis Zanoni, and Lucian Barton had devised a method for electronic control of light reflected from liquid crystals. Their first liquid crystal

display was replaced by a more efficient version designed by American James Fergason in 1969. It is Fergason's design which forms the basis of all present-day flat screen technology.

- The first public broadcasts of television were carried out in 1928 in New York, with the receivers being built by Alexander Graham Bell's company, General Electric, while the first public broadcasting of television programs took place in London in 1936.

- Color television was conceptualized and demonstrated by John Logie Baird in 1928, by using a Nipkow disk containing the three primary colors: red, yellow, and blue.

The system of using the primary colors was perfected in 1953, and color television was introduced in that year. In later applications, such as in television cathode ray tubes, these primary colors were changed to red, green, and blue.

Flight—from Balloons to Jets in Forty Years

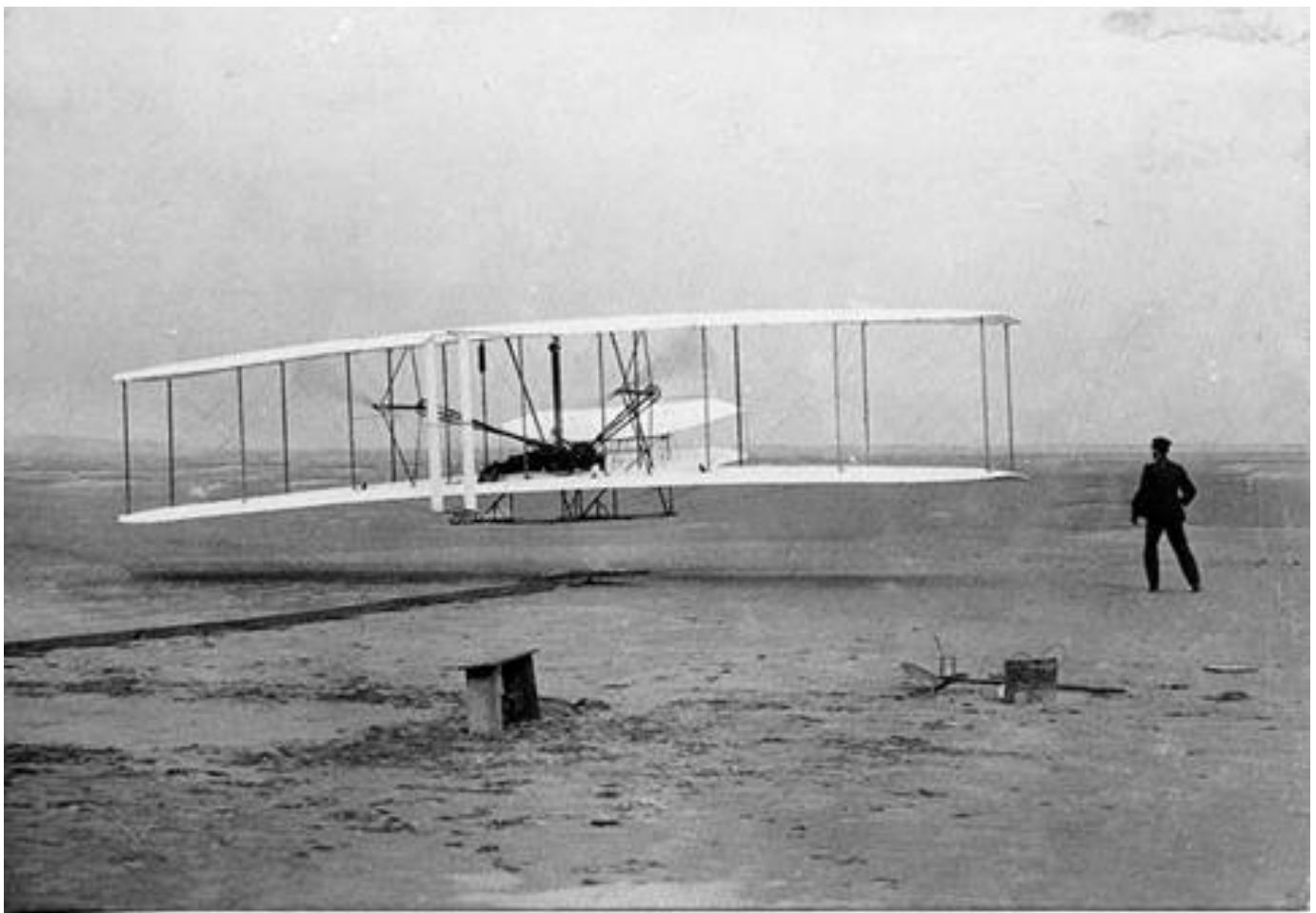
The first lighter than air flights were undertaken in 1783, by two French brothers, Jacques and Joseph Montgolfier, who used heated air in balloons. That same year the French physicist Jean Francois de Rozier made the first manned balloon flights near Paris. In 1785, the French aeronaut Jean Pierre Blanchard, accompanied by the American John Jeffries, made the first balloon crossing of the English Channel.

Sir George Cayley (1773–1857) was an English inventor who developed the concept of the modern airplane and is considered to be the founder of the science of aerodynamics. The essential form of the modern airplane, a rigid-wing structure driven by a then yet to be invented engine, was designed by Cayley in 1799.

In 1808, Cayley persuaded his coachman to man a glider he had built which was then launched. It carried the protesting employee some 275 meters (900 feet), before crashing and became the first recorded flight by any person in an aircraft. Cayley published his findings in a paper, "On Aerial Navigation" (1810), which earned him the title of the Father of Aviation. In this paper he laid out the basic ground rules for aviation which are still in use to this day, namely, inclined rigid wings, rudder steering control, and streamlining.

The American inventor Samuel Langley built the first heavier-than-air self-propelled aircraft in 1896. His aircraft, which he called the *Aerodrome*, was launched by catapult on the Potomac River in Virginia. It was unmanned, but still won renown for being able to fly under its own power.

FIRST MANNED FLIGHT—WRIGHT BROTHERS AT KITTY HAWK, NORTH CAROLINA 1903



First successful flight of the Wright Flyer, by the Wright brothers. The machine traveled 120 ft (36.6 m) in twelve seconds at Kitty Hawk, North Carolina. Orville Wright was at the controls and Wilbur Wright ran alongside to balance the machine, and had just released his hold on the machine in this famous photograph. It was a mere seventy-five years from this flight to the building of the first Boeing 747 "Jumbo" jet airliner, an aircraft which had a wingspan longer than the Wright brothers' first flight.

The Wright brothers, Wilbur and Orville, undertook the first manned powered aircraft flight in December 1903, at Kitty Hawk, North Carolina. Orville Wright, who manned the flight, also invented the first wind tunnel in 1901 as part of the brothers' experimentation to find the correct wing shape. From then on, the design of aircraft improved by leaps and bounds. It was spurred on by two world wars, both of which saw aircraft being turned to military applications.

Long-Distance Flight

In 1909, the French aviator Louis Bleriot crossed the English Channel in an aircraft. In 1910, the American pilot, Eugene Ely, perfected the concept of taking off and landing on ships, and in 1911, the US Army used a Wright brothers' biplane to make the first live bombing test from an airplane. In 1911, the American inventor and aviator Glenn Curtiss introduced the first practical seaplane.

The first long-distance flight took place in 1913 when aircraft were flown from France to North Africa, and the first commercial aviation service started in January of 1914, just ten years after the Wrights' first flight. This first airline operated between Saint Petersburg and Tampa in Florida.

Jet Aircraft

The first jet engine was designed and built in 1937 by the British engineer Sir Frank Whittle.

Within two years, a German aeronautical engineer, Willhelm Messerschmitt, produced a German version of the jet engine. In 1939, Messerschmitt produced the first aircraft to be powered by a jet engine and the world's first jet-powered flight took place in Nazi Germany that year.

The Nazis maintained their lead in jet engine propulsion throughout the Second World War. The world's first operational jet fighter, the Messerschmitt Me 262 was put into service in November 1944 and was followed with the world's first rocket-powered interceptor, the Messerschmitt Me 163 *Komet*.

ME 262—FIRST OPERATIONAL JET FIGHTER 1944



The Messerschmitt Me 262 Schwalbe ("swallow") was the first operational jet-powered fighter. Some 1,433 ME 262 aircraft were produced, but only about 300 were ever used in combat. This revolutionary aircraft entered service too late to affect the outcome of the war, but had a significant influence on postwar aircraft development. At the end of the war, the Me 262 and other advanced German technological breakthroughs were snapped up by the Soviets and the Americans. The Me 262 formed the basis of early US and Soviet jet fighters such as the F-86 Sabre and the Sukhoi Su-9.

After the war, Messerschmitt's jets and engines were copied and laid the basis for all military and commercial jet aircraft since. The world's first jet passenger airliners entered service in the early 1950s. In 1958, jet aircraft travel was revolutionized once again with the introduction of the first Boeing 707 jetliner in America. Boeing has continued to dominate the world airliner travel market, and has only been matched by the European Airbus consortium.

The Helicopter

The first recorded design of a helicopter (which was never built) is to be found in the drawings of Leonardo da Vinci dating from the year 1500. Although Da Vinci never saw his idea take practical form, the basic idea he conceptualized formed the basis of the development of the helicopter.

Many inventors tried their hand at perfecting the original Da Vinci design, but the first successful helicopter was a twin-rotor machine designed by the German engineer Heinrich Focke, which was flown in 1936 in Nazi Germany.

This was followed in 1939 by the Russian-American Igor Sikorsky's single rotor helicopter which made its first flight in Ohio. After the Second World War, the helicopter was refined and became common in both military and civilian applications.

Atomic Power

The British chemist John Dalton (1766–1844) is regarded as the father of atomic theory. He believed that the particles or atoms of different elements were distinguished from one another by their weights, and in 1803, published the first table of comparative atomic weights, inaugurating the quantitative atomic theory.

The next great step in atomic research came in 1895, when the German scientist Wilhelm Conrad Roentgen invented the technology known as x-rays.

The French scientist, Pierre Curie, and his Polish wife, Marie, made a number of breakthroughs in the study and research of nuclear energy at the turn of the nineteenth century. They discovered the elements polonium and radium and Marie became the first scientist to isolate the pure metal radium. One of the Curies' contemporaries was the British physicist Ernest Rutherford, who discovered the alpha, beta, and gamma rays emitted by radiation. This allowed scientists to explore the secrets of the atom. Rutherford established that the mass of the atom is concentrated in its nucleus and that electrons circle the nucleus, each with different electrical charges.

In 1930, the American physicist, Ernest Lawrence, developed the first particle accelerator, called a cyclotron.

Nuclear Reactions

In 1932, two British scientists, Sir John D. Cockcroft and Ernest Thomas Sinton Walton, were the first to use artificially accelerated particles to successfully disintegrate the nucleus of an atom. They produced a beam of protons (positive particles) which were boosted to high speed by means of a high-voltage device called a voltage multiplier. These particles were used to bombard a lithium target which then disintegrated the chemical's atoms.

Nuclear Applications

It was inevitable that the advent of the Second World War would see nuclear research turned to military purposes. Scientists in both Germany and America worked feverishly to build an atom bomb. The Germans were the first to start with nuclear fission experiments (fission being the igniter for a nuclear reaction) but their efforts were hampered by the large-scale Allied bombing.

Meanwhile, the Italian-American scientist Enrico Fermi perfected nuclear fission. A team was set up under great secrecy to develop the atom bomb under the code name the "Manhattan

Project.” The practical steps involved in adapting Fermi’s fission device into a bomb which could be delivered by air were completed by mid-1945. The atom bomb was used against Japan and ended the Second World War in a mushroom cloud.

After the war, nuclear research was adapted to civilian applications. By the 1950s and early 1960s, nuclear power plants had been built in Western Europe, America, and the Soviet Union to manufacture electrical power.

Nuclear power plants around the world have suffered at least twenty major incidents involving the leakage of radioactive materials from 1961 to 2011, and as a result, some nations are reconsidering the use of this technology as a power-generating source.

Space Exploration

Almost all theory of space flight was worked out by three brilliant men over a period of nearly three centuries, from 1600 to 1900. Johannes Kepler was a German mathematician who, in 1609, developed the equations for orbiting planets and satellites. In particular, he determined that the planets move in ellipses (flattened circles) rather than true circles.

Isaac Newton was the English scientist who, in 1687, wrote what is probably the single greatest intellectual achievement of all time. In his book, *Principia*, he established the basic laws of force, motion, and gravitation and, in the process, invented calculus, a new branch of mathematics. He did all this to prove the validity of Kepler’s equations which show that the force of gravity is the reason for the planets’ orbital courses.

The Russian schoolteacher Konstantin Tsiolkovsky published all the basic equations required for modern rocketry in his 1903 book, *The Exploration of Cosmic Space by Means of Reaction Devices*. In this work, he anticipated and solved many of the problems which faced rocket designers and determined that liquid fuel rockets would be the best means of propelling manmade objects into space. He also wrote that rockets would need to be built in stages (which he called “rocket trains”) and that oxygen and hydrogen would be the best fuels for the science of rocketry.

Robert Goddard—First Rockets

The American scientist, Dr. Robert H. Goddard, is considered to be the father of practical modern rocketry. His experiments with solid and liquid fueled rockets formed much of the basis of the development of ballistic missiles, earth-orbiting satellites, and interplanetary exploration. Goddard launched his first rocket in 1926 in Massachusetts, and although it only flew for 2.5 seconds, he showed that rockets could work. In 1930, he launched the world’s first truly successful rocket, which reached two thousand feet and a speed of five hundred miles per hour.

ROBERT GODDARD—WORLD’S FIRST LIQUID-FUELED ROCKET



American physicist professor Robert Goddard (1882–1945) built the world's first working liquid-fueled rocket, launched on March 16, 1926. Goddard's pioneering work was largely ignored in his native America, but exploited in Germany by Nazi rocket scientists who perfected the technology.

Nazi Rockets Led the Space Race

The German rocket scientist, Hermann Oberth, is known as the father of space travel for his groundbreaking 1923 book, *The Rocket into Planetary Space*. Oberth's ideas were well received by Adolf Hitler, and funding was made available to Oberth to assemble a rocket research and development team. One of the scientists who Oberth recruited was Wernher von Braun (1912–1977). Von Braun's team developed the first Intercontinental Ballistic Missile (ICBM) in the world, known as the A4, or, in the common parlance, the V-2 rocket. This weapon was used to bombard Britain and Antwerp in the closing months of the Second World War and was the first manmade object to reach space, which it penetrated at the apogee of its flight.

At the end of the Second World War, Von Braun arranged for five hundred of his top staff, one hundred remaining V-2 rockets, and documentation to be handed over to the American army. This gamble paid dividends and he and most of his colleagues were whisked off to America to work in the US's military programs.

The Soviets captured some stragglers who were taken back to Russia and put to work.

There they produced the first long-range Soviet missiles, known as Scuds, and helped develop the Soviet space program. The first Soviet satellite, *Sputnik 1*, was launched in 1957, followed in 1961 by the first manned spaceflight, that of Yuri Gagarin. In both cases it was a derivation of the V-2 rocket which put the Soviets into space.

Meanwhile, in America, about two thirds of the original V-2 team had been reassembled at the White Sands Proving Grounds, New Mexico. Led by Von Braun and Oberth, the team continued their work, and in 1950 Von Braun was transferred to Huntsville, Alabama, where for ten years he headed the Redstone missile program. He became a naturalized US citizen in 1955.

In 1958, the first American satellite was launched, again using a V-2 derivative rocket as its launch vehicle. After Oberth retired in 1960, Von Braun was appointed director of development operations at the George C. Marshall Space Flight Center under the aegis of the National Aeronautics and Space Administration (NASA) in Huntsville. There the original V-2 rocket was redeveloped into a launch vehicle called the Redstone rocket. The first American astronaut to enter space, Alan Shepard, was carried into sub orbit by a Redstone rocket.

Von Braun's last great contribution to space exploration was his design of the *Saturn V* rocket, which was the most powerful machine ever built by man. This rocket was specifically engineered to take men to the moon and achieved this goal with the Apollo 11 mission which saw astronauts Neil Armstrong and Edwin Aldrin become the first humans to walk on the surface of another celestial body. They were followed by five further successful manned missions to the moon. In total, twelve men walked on the moon's surface before the program was halted.

VON BRAUN'S GREATEST DESIGN—THE *SATURN V*



Dr. Wernher von Braun and Dr. Kurt Debus, both former Nazi rocket scientists, pictured with their greatest invention, the Saturn V rocket. This space vehicle, the most powerful machine ever built by man, weighed 6.5 million pounds and stood some 364 feet high. It was the primary launch vehicle for man's exploration of the moon and also launched the Skylab orbiting space station into earth's orbit.

The American space program then switched to building an orbiting space station. By 1973, the world's first such station, called Skylab, had been launched by one of the last *Saturn V* rockets. The Soviet Union duplicated these missions with the Soyuz space station program, and even entered into a joint mission with American astronauts.

The next technological breakthrough was the development of a reusable space craft. Both the Soviets and the Americans developed reusable craft, but the US version was the first to become operational as the space shuttle. The Soviet program collapsed after the fall of the Soviet Union and never actually flew, even though one full-size craft had been built.

Political Correctness Affects NASA

It was during the space shuttle program that liberals first noticed that the entire space program—from scientists to astronauts—had been exclusively white. Objections were raised, first at the presence of some of Von Braun's original team (one was stripped of his American citizenship

and deported back to Germany, nearly forty years after he had first arrived), and then because there were no nonwhite astronauts. NASA was ordered to enforce an affirmative action program and find nonwhite astronauts.

Almost Unknown but Important

In addition to the famous inventors, there are a number of others who are almost unknown, but whose contributions to modern society are no less important.

- James King was an American who, in 1851, patented the first washing machine to use a drum. The first electric powered washing machine was introduced in 1908 by the Hurley Machine Company of Chicago, Illinois.

- Rowland Hill, a schoolmaster in England, invented the postage stamp in 1837, an act for which he was knighted. Through his efforts, the first stamp in the world was issued in England in 1840.

- Jesse W. Reno was an American who patented the first inclined conveyor belt in 1891. In 1900, the American inventor Charles D. Seeberger added steps to the conveyor belt and thereby created the present-day escalator.

- Charles Hanson Greville was an English scientist who, in 1860, first identified the chemical properties in natural rubber. This made possible the development of synthetic rubbers.

Research by teams of scientists in Germany and the United States resulted in the production of the first viable synthetic rubbers in America after the Second World War.

- Robert W. Thompson was a Scottish inventor who, in 1845, developed the first pneumatic tire.

- John Wesley Hyatt was an American who developed modern plastics in 1870 after entering a competition held by a billiard ball manufacturer who wanted an alternative to ivory.

Hyatt developed a method of pressure-working pyroxylin, a cellulose nitrate of low nitration that had been plasticized with camphor and an alcohol solvent. The substance, patented under the trademark Celluloid, was the first plastic. This process led to the plastics industry.

- In 1920, the German chemist Hermann Staudinger discovered the existence of macromolecules, which he called polymers. This breakthrough created the science upon which all modern polymer plastics were developed.

- Leo Hendrik Baekeland was a Belgian-American chemist who invented Bakelite, an early resin, in 1906.

- Johan Vaaler was a Norwegian who invented the paper clip in 1899.

- Percy Spencer was an American who invented the microwave oven in the late 1950s after experiments with a magnetron, a device designed to produce short radio waves for a radar system.

- The Frenchman Claude Chappe invented the mechanical semaphore system for ships in 1792.

- William Murdock was an Englishman who invented practical industrial-scale gas lighting

—later extended to streets—in 1802.

- Jean Jacques Dony was a Belgian who was the first to produce an extract of zinc in 1805.
- Friedrich Woehler was a German who, in 1827, was the first to produce an extract of aluminum from clay.
- Nicolas Appert was a Frenchman who developed the technique for the sterilization of tinned food in 1809.
- Benjamin Delessert was a Frenchman who extracted sugar from beet sugar in 1812.
- Aristide Bergès was a Frenchman who designed the first hydroelectric station in the world in France in 1870.
- Henri Sainte-Claire was a Frenchman who started the first industrial aluminum production in 1854.
- Ernest Solvay was a Belgian who started the first industrial soda production in 1861.
- Hilaire de Charbonnet was a Frenchman who invented artificial silk in 1884.
- Charles Tellier was a Frenchman who invented the modern refrigerator in 1867.
- Percy Gilchrist and Sidney Thomas were two Englishmen who jointly extracted the first phosphorus from iron in 1875.
- P.L.T. Heroult in France, and C.M. Hall in America, independently produced aluminum by electrolysis in 1866.
- Eugene Turpin was a Frenchman who invented melinite, an explosive charge, in 1892.
- Herman Dresser was a German chemist who invented aspirin in 1893.
- Frederick Hopkins was an Englishman who discovered the existence of vitamins in 1912.

Racial Implications

As the reader can see, it is no exaggeration to say that white inventors were responsible for almost every technological breakthrough in use in the world today.

White technological know-how has physically shaped the face of the earth, despite white people being an absolute minority of the globe's population.